

Progress and Innovation: Award Outcomes

Award Statistics

The first project awarded PPD funds began, administratively, in October of 1992³; program awards subsequently ranged from 4 to 16 grants annually. Average project awards were also variable, from a low of \$150,254 in 1993 to a high of \$657,903 in 1994. Since 1992, the number of active PPD projects has increased steadily; as of FY 2001, the program's tenth year, there were 49 active PPD projects in 24 states. To date, PPD has made 92 awards among projects in 30 states and the District of Columbia with a total disbursement of \$39,426,107 or an average annual disbursement of approximately \$3.9 million. Awardees have included 66 principal investigators representing 56 sponsors. The program has received an average of 49 full proposals and granted an average of 9.9 awards per year, with the average award through FY 2001 calculated as \$433,254 and approximately 2.7 years' duration.

PPD award averages, by year

Year	No. of Projects Begun	Avg. Award Commitment	Avg. Project Duration (Years)
1992 ⁴	4	\$438,444	2.0
1993 ⁴	4	\$150,254	2.6
1994	13	\$657,963	2.2
1995	9	\$562,910	2.3
1996	6	\$372,466	2.3
1997	9	\$231,865	3.9
1998	16	\$529,170	2.5
1999	11	\$374,727	2.8
2000	11	\$397,812	3.1
2001	16	\$386,238	2.8
Average	9.9	\$433,254	2.7

PPD award numbers and state representation, by year

Year	Total Award Commitments	Number of Active Projects	Number of States with Active Projects
1992 ⁴	\$ 1,753,776	4	4
1993 ⁴	\$ 901,523	7	6
1994	\$ 7,895,561	18	12
1995	\$ 3,940,370	24	15
1996	\$ 1,862,332	24	17
1997	\$ 1,854,916	29	19
1998	\$ 8,995,890	40	21
1999	\$ 5,995,635	39	21
2000	\$ 1,591,247	43	22
2001	\$ 4,634,857	49	24

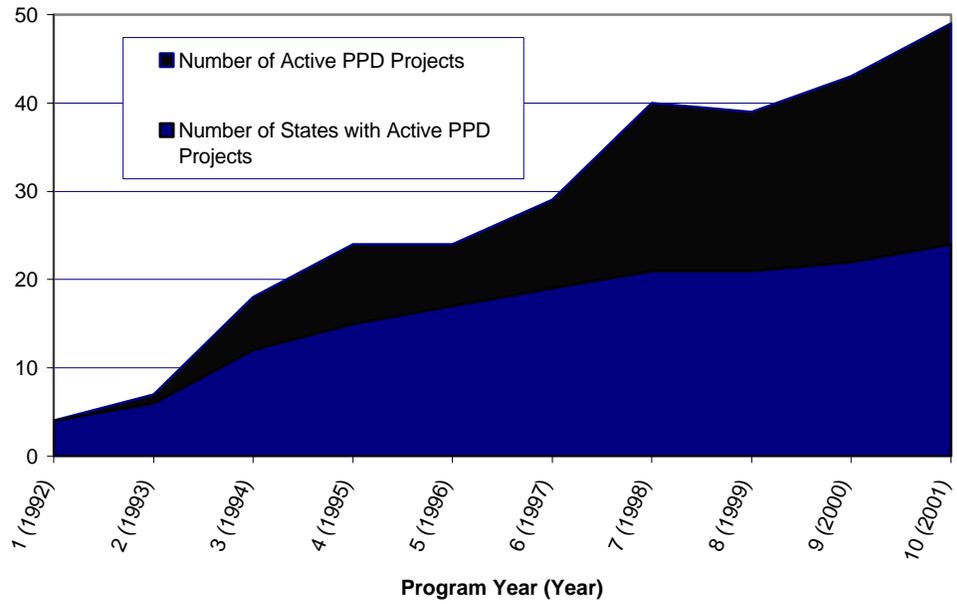
Source: NSF FastLane.

³ Though addressing students with disabilities, award #9153492 to East Carolina University (began in January, 1992) was actually administered through NSF's Directorate for Mathematical and Physical Sciences.

⁴ Data include 2 FY 92 and 2 FY 93 projects totaling \$681,328 administered in conjunction with the Career Access Program. PPD staff monitored eight programs on disability research and education and funded four unsolicited proposals.

PPD Project Activity, 1992 - 2001

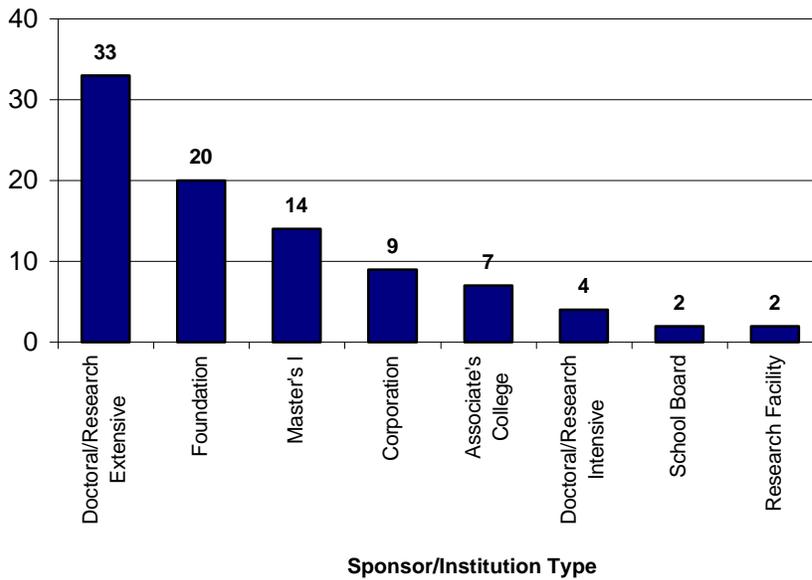
Number of Active Projects/States



Source: NSF Division of Human Resource Development.

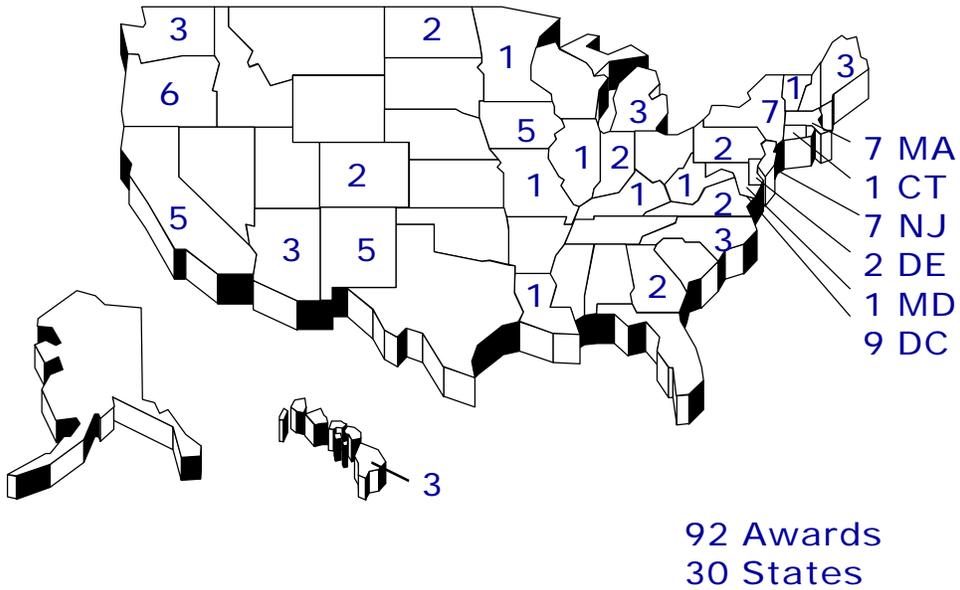
PPD Awards by Carnegie Foundation Classification, 1992 – 2001

Number of Awards



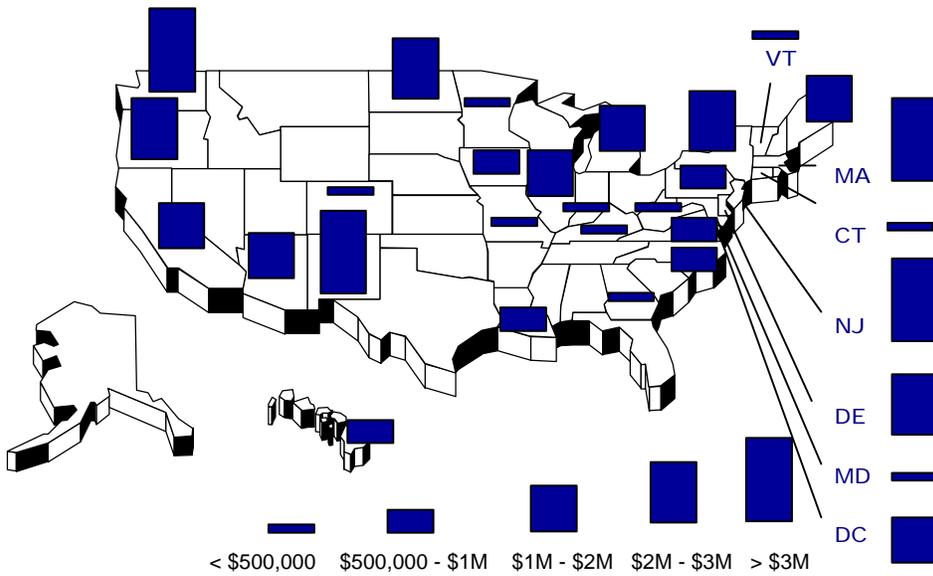
Source: NSF Division of Human Resource Development.

PPD Awards by State, 1992 - 2001



Source: NSF Division of Human Resource Development.

PPD Funding by State, 1992 - 2001



Source: NSF Division of Human Resource Development.

Taken collectively, PPD awards very nearly represent a microcosm of NSF's programs and missions in education, numerically as well as philosophically. Among the 92 projects, 26 percent proposed methods or products that could be considered applicable—directly or by broader application—to all students in any STEM discipline. A further 19 percent specifically addressed K-12 students; 25 percent addressed undergraduates; 23 percent addressed teachers, teacher educators, parents, and counselors; and 8 percent addressed the general public via commercial products or informal education facilities and exhibits.

Among the goals specified by award abstracts, 22 projects (24 percent) focused on improved pedagogical methods or products designed to engage and retain students with disabilities to STEM education and 17 projects (18 percent) identified college or career preparation skills. Fifteen awards (16 percent) identified women and girls with disabilities or students in rural or remote locales as their main target audience. Six projects (7 percent) specified the involvement of caregivers or family members to encourage and fulfill the responsibility to the whole student and education's role within the entire lifestyle. Finally, nine projects (10 percent) sought to promote information exchange via conferences or directories and catalogs of extant products, research, or resources. These projects were crucial not only to identify common areas most in need of attention but also to provide a baseline of known results upon which future efforts should be based.

In FY 2000, PPD received 81 preliminary proposals and 54 full proposals, representing all of the program's research tracks. For FY 2001, the requirement for preliminary proposals was waived and award criteria shifted to a regional alliance model, including collaboration-based projects with a strong knowledge of other activities in the community and an emphasis on recruiting and training students with disabilities. In response to these revised requirements, only 10 full proposals were received by the submission FY 2001 deadline, of which 9 were forwarded for panel review. These proposals represented a total Year-1 request of \$5,726,959 with an average project Year-1 request of \$572,695 and an average proposed duration of 4.7 years. Eight of the 10 proposed five-year plans included regional or local networks of institutions and represented nine different states, including four states not previously awarded PPD grants. Typically, preliminary proposals have been submitted by as many as 38 different states, the District of Columbia, and Puerto Rico in response to each program solicitation. Except for facilitation awards, countless requests from researchers, educators, and students for individual support must also go unfulfilled because direct support is not included in PPD's mandate. However, such observations provide a clear indication that there is a broad, nationwide interest in PPD initiatives, including the new Regional Alliances.

Milestones

Through reports, meetings with project directors, and site visits, the program staff is kept well informed of the successes and revised strategies of all PPD projects. Reports submitted by various projects estimate that over 70 percent of students with disabilities in PPD projects go on to studies in higher education studies, with the majority of them in STEM courses. (The majority of these students reported little or no such motivation prior to participating in PPD projects.) Some are better or more easily able to obtain work in private industry because of their experiences in these projects.

In the first two years of PPD operation, program staff focused their efforts on: 1) information dissemination and outreach to NSF program staff and the science and education communities at large concerning the goals of PPD; 2) promotion of opportunities provided through facilitation awards to scientists and engineers with disabilities; 3) preparation and publication of a program guide; and 4) management of the review of unsolicited proposals and processing and management of four new awards and five continuing projects begun under the Career Access Program.

As is typical of many programs, several initial proposals sought funds to facilitate communication and determination of baseline issues via directories, resource guides, and conferences. Publications that offered career options available to persons with disabilities were also popular among early PPD awards. Expectedly, the awards well represented the program's mandate—

1. To ensure accessibility of instructional materials, educational media and technology, and informal science educational opportunities and facilities;
2. To develop and test innovative techniques and activities that will increase the recruitment, training, and retention of students with disabilities in science, engineering, and mathematics education; and
3. To change attitudes of pre-college teachers and college faculty in science and mathematics toward the ability of students with disabilities to perform competitively in their disciplines and to provide them with the knowledge needed to make classrooms and laboratories accessible to students with disabilities.



For the interested reader, project abstracts and detailed award information for the PPD projects summarized on the following pages can be searched at: <http://www.fastlane.nsf.gov/a6/A6AwardSearch.htm> using the award number indicated in parentheses.

The University of Washington's DO-IT (Disabilities, Opportunities, Internetworking, and Technology) project (#9255803, \$1,543,804) was the first to receive long-term funding from PPD. It was also among the first program awards to show tangible impacts in the community. DO-IT began in October 1992 with the intent of recruiting and retaining more students with disabilities in academic and professional careers in science, mathematics, engineering, and technology. To this day, the project introduces students to adaptive technology that helps them access computers and the Internet; counsels high-school students in career and college transition; and prepares faculty, staff, and institutions of higher learning to better receive such students. DO-IT's activities also extend beyond the classroom to include camps, summer programs, mentoring, and exposure to various career fields. PPD has also encouraged the dissemination of DO-IT materials and information through various print and electronic media.

With the exception of the University of Washington grant and FY 1994 awards to the Foundation@NJIT (#9450074, \$1,223,574), the University of Illinois Urbana-Champaign (#9450020, \$1,660,246), and the University of Delaware (#9450019, \$1,418,141), most of PPD's early awards were in the \$100,000 range or less. The Foundation@NJIT project was designed to promote better inclusion of students with disabilities through improved access and more inclusive teaching methods. The proposal, which included the teaming of science, engineering, and mathematics (SEM) teachers with experts in accessibility issues, offered a cornerstone practice reflected in many PPD projects today. Illinois' "Project PRIMES (Promoting & Retaining In Math, Engineering & Science)" and Delaware's "Engaging, Recruiting, Retaining Students with Disabilities in SEM" were similarly configured as experimental projects aiming to increase the retention and enrollment of STEM students with disabilities. Additionally, their intent was to better identify factors leading to the observed inequity in the representation of such students using workshops and seminars addressing equitable access to education. Projects began to research the environmental factors that might promote or discourage persons with disabilities considering careers in STEM; activities to attract and retain disabled persons in scientific careers were immediate outcomes of these efforts. Coincident with this was the development of more products to better facilitate the delivery of complex material to the visually and hearing impaired. Other noteworthy awardees included Oregon State University's "Science, Engineering, Education and Disabilities (SEED)" project (#9452881, \$1,050,940) and the University of North Dakota's, "Enhancement of Mathematics and Science for Fourth and Fifth Grade Native American Students with Disabilities" (#945007, \$1,336,552). The mode amount for other projects had by this time approached \$200,000 by FY 1994 and would approach half a million dollars per award by the end of the decade.

Project rewards were realized early, particularly with regard to human factors in the PPD community. In New Jersey, the effect on the families and educators of students with disabilities were profoundly affected by the PPD project at the New Jersey Institute of Technology (NJIT). Not only was the students' interest in STEM increased, but the harmony and support of the communities in which they lived were also enhanced. The PPD award to the University of Delaware also yielded a host of results in areas such as haptic feedback and improved tactile pictures. An award to the City University of New York (#9450166, \$382,092) also produced advances in technology and techniques in the form of an improved touch tablet and improved presentation of tactile graphics.

In FY 1995, the University of Washington was given a further \$1,539,282 for its DO-IT Extension project (#9550003) and a \$1,508,302 award to New Mexico State University (#9550064) provided seed funding for its Regional Alliance on Science Engineering and Mathematics for Students with Disabilities (RASEM). RASEM continues in 2001 with eight internships and impacting approximately 25 undergraduates with outreach to hundreds of high-school students. In proposing measures for, respectively, adapting and adopting proven practices and forming alliances among regional networks, both of these projects proved to be exemplars for future programmatic directions in PPD and throughout NSF's Directorate for Education and Human Resources.

FY 1996 included an award to the WGBH Educational Foundation's "CD-ROM ACCESS Project" (#9623958, \$600,000), an initiative to draft a set of design guidelines for making CD-ROMs more accessible to the visually and hearing impaired. Libraries, publishers, and the media have received the guidelines with great interest; now the center is applying the design parameters to its own adaptation of the physics interactive video tutor project (PIVOT, #9906159) first developed at the Massachusetts Institute of Technology. An award to Recording for the Blind, Inc. (#9610308, \$300,000) helped to develop digital audio recording with text support for dyslexics. Elsewhere, the "Enabling SUCCESS" project at Louisiana Tech University (#9622322, \$553,289) sought to develop inexpensive and practical science-activity kits for use at home as well as in the classroom. Hands-on experiments using little more than economical and readily accessible materials were highly successful in engaging middle-school students' interest in the pursuit of science. The project developed a science-activity kit and accompanying manual for home and classroom use that did show an initial increase in STEM interest (and high-school enrollment by participants).

By FY 1997, several PPD projects had identified the need for better tools and technologies to retain the interest of STEM students with disabilities. Representative of these awards are the American Association for Higher Education's use of adaptive computer technology to prepare K-12 students (#9700134, \$222,649), CAST, Inc.'s, "Understanding Science Through Captioning Project" for hearing impaired students (#9712964, \$207,121), Purdue University's audiotactile general chemistry course for visually impaired students (#9722030, \$221,385), and Space is Special, Inc.'s, project, "Using Space Science to Enhance Science, Mathematics, Technology Skills and Self-Esteem in Special Needs Students" (#9732913, \$436,850).

Into FY 1998 and FY 1999, PPD awards continued to reach out to "minorities within the minority," including female, rural, and American Indian/Alaskan Native/Pacific Islander students. The University of North Dakota received funding (#9800634, \$900,000) for its "Disability Research Encompassing American Indians in Math and Science (DREAMS)" project. The University of Hawaii Manoa was awarded a grant (#9800692, \$462,882) for its "Ocean of Potentiality" project. In Hawaii, students at all levels as well as their teachers and counselors are afforded fun, instructive hands-on science experiences. The goodwill on behalf of science afforded by such projects extends far beyond individual participants to benefit relatively isolated communities. The project's principal investigator, marine biologist Richard Radtke, was also one of ten individuals nationwide to receive NSF's Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM) in 1999. During FY 1998, PPD support was continued for projects ongoing at the University of Washington, Oregon State University, New Mexico State University, the University of Delaware, and the Foundation@NJIT with awards to these centers averaging approximately \$800,000.

Taking science education beyond the classroom, the New York Hall of Science (#9800577, \$186,377) was awarded a PPD grant for their proposal to provide visitors to science museums with enhanced audio tours. The Association of Science-Technology Centers also received PPD funds (#9906095, \$467,921) for their proposal for making science-center exhibits more appealing, accessible, and rewarding for all persons with disabilities. An award to San Francisco State University (#9800281, \$388,698) helped to produce a Braille periodic table and some remarkable new 3-dimensional models for the study of biochemistry.

Among other noteworthy PPD projects, a multi-year effort at the Marie H. Katzenbach School for the Deaf (#9906123, \$439,474) has developed a distance-learning project to increase the interest in science and science aptitude for deaf and

hard of hearing students in kindergarten through twelfth grade. At Duke University (#9800201, \$449,972), a system of tiered mentoring is impacting students through the entirety of the supply pipeline, grade school through graduate study.

Two FY 2000 awards to TERC, Inc. (#0090070, \$449,999 and #0095392, \$448,403) will help apply National Council of Teachers of Mathematics (NCTM) standards-based curricula to students with disabilities and will develop the SigningAvatar™ to accentuate distance-learning programs. Other new PPD projects such as the Rochester Institute of Technology's Clearinghouse on Mathematics, Engineering, Technology, and Science (COMETS, #0095948) will provide unprecedented on-line access to education materials for hard-of-hearing students and their mentors, tutors, and caregivers.

Viewed from a national perspective, the program's awards are clearly starting to produce tangible results in three broad-based categories: 1) Products; 2) Improving educational environments; and 3) Advances in teacher practices and standards-based teaching for students with disabilities in STEM disciplines.

Products

Among the products of PPD projects highlighted in the program's annual reports (HRD 1994-2001) are—

- Live interviews, print materials, on-line courses and discussion lists, and Web broadcasts of weekly interviews with research and education leaders working in the STEM fields. — *Teaching, Learning and Technology Group/Equal Access to Software and Information, American Association for Higher Education* (#9906134).
- Computer-controlled chemistry and physics lab experiments (including computers running software for visually and mobility impaired students) and a resource guide for teachers to implement these technologies elsewhere. — *Georgia Tech Research Corporation* (#9700150).
- Use of a force-feedback mouse to enable better comprehension of two-dimensional graphs by visually impaired students has been developed by PPD-funded researchers in Virginia. — *Automated Functions, Inc.* (#9906143).
- The Accessible Graphing Calculator (AGC), a Windows application that makes mathematics more accessible to the blind or dyslexic and learning math more fun for everyone. The AGC is designed to be equally usable either visually or audibly via a speech engine included with the product. For non-disabled students, the audible tones can make learning more fun, reducing “math anxiety,” increasing numerical comprehension, and even enhancing the learning process by doubling the user's sensory perceptions. — *Oregon State University* (#9800041).

Improving Educational Environments

As a result of the products such as those listed above, PPD-supported initiatives are making an impact on the learning environment for persons with disabilities, including—

- Videos from the DO-IT project have been disseminated nation-wide to affect change in pre-college science and math pedagogy. —*University of Washington* (#9800324).
- The web site for Equal Access to Software and Information (Washington, DC) is receiving an increased number of visits and requests for information as K-12 science and mathematics teachers seek accommodations for students with disabilities. —*Teaching, Learning and Technology Group/Equal Access to Software and Information, American Association for Higher Education* (#9906134).
- In Massachusetts, the Center for Accessible Media is receiving an increased number of requests to assist in providing closed-captioning and audio description of STEM instructional media. —*CPB/WGBH National Center for Accessible Media* (#9906159).
- The New York Hall of Science is beginning to receive requests for assistance in making other informal science programs accessible to students with disabilities. —*New York Hall of Science* (#9800577).
- The University of Northern Iowa (#9988729 and others) recently published two volumes on “Science Teaching in Inclusive Classrooms” of use to anyone trying to address issues of parity and equity in diverse classrooms. —*University of Northern Iowa* (#9988729 and others)
- At the University of Washington (#9800324) and New Mexico State University (#9800298), PPD-supported projects with extensive undergraduate-student activities are now graduating students with disabilities who have completed their baccalaureate degrees. Among them, three graduates have moved from schools of engineering into employment in industry and two physical-sciences graduates elected to continue academic training in graduate school.

Advances in Teacher Practices and Standards-Based Teaching

Advances in standards-based teaching and assessment as a result of PPD funding include—

- The Education Development Center (EDC) in Massachusetts has been developing materials to use with national and state science and mathematics standards programs to promote accessibility for students with disabilities. EDC’s efforts address this important issue while new educational standards are developed and revised. Similarly, EDC is working with the Educational Testing Service and other national assessment organizations in efforts to ensure that future assessment instruments for science and mathematics will be appropriately accessible for students with disabilities. —*Education Development Center* (#9800287).

- Rutgers University is adapting its science teams project for racial- and gender-equity in the classroom to include students with disabilities. The project is devising a professional-development program especially for teachers of third- to fifth-grade students with special needs. The teams' outreach tools include hands-on environmental science activities, suggestions for promoting inclusion of students with special needs, and an emphasis on balanced, cooperative learning strategies intended to encourage and support all science students, regardless of their ability.—*Rutgers University New Brunswick* (#9800336).
- The PPD-supported “Daughters with Disabilities” (DWD) project is showing special education and general elementary school teachers engaging, hands-on methods in STEM education adapted to the special requirements of their students. —*Temple University* (#9906079).

Learning Valuable Lessons Through Necessity

As summarized by Scadden (2001), PPD projects have long dealt with several issues only now being addressed by most curriculum designers:

“Educators working with disabled students have found themselves on the leading edge of techniques now considered state-of-the-art. Most, if not all, PPD projects necessarily address many of the self-same principles now being adopted across the board as effective teaching. These include:

- structuring lesson plans and exercises to encourage participation, increase retention, and provide the student with a positive experience that fosters the need for ongoing study;
- promoting self-esteem in the student and involving teachers, parents, counselors and caregivers in the education process beyond the classroom;
- diversifying content delivery from text- or lecture-only formats;
- accommodating alternate learning styles by using hands-on experiences and by engaging multiple or concurrent sensory channels;
- employing peer instruction and active participation in smaller student groups; and
- facilitating distance learning and tele-learning for students in rural or remote locales.”

Guiding Principles for New Proposals

The opportunity to review PPD proposals—successful as well as not—and to chart the progress of many funded projects for the past decade have revealed to program staff a number of guiding principles that could well be applied to the years ahead.

1. Proposals should provide an intelligent, research-based plan of action with realistic, defined outcomes.
2. Project management should be established and leadership must be consistent. Changing principal investigators mid-course can drastically cost projects time, progress, and organization.
3. Seek to make a difference. Changing attitudes, beliefs, and practices is more important than absolute numbers, at least initially.
4. Numbers are important, too, especially in light of the Government Performance and Results Act (GPRA) and Government Accounting Office standards for increases in performance-based outcomes.
5. Actively seek partnerships for product development and networks for dissemination of information and proven good practices: Consult other PPD awardees; communicate with local and regional institutions; partner with special-needs as well as mainstream curricula; and use non-profit societies or similar venues established in the community to disseminate results to the broader public.
6. If a project's methods are demonstrating tangible results, support and perseverance should be encouraged to the maximum extent possible, finding alternate sources of funding, approaching other institutions, or appealing to other principal investigators if necessary. Every reasonable attempt should be made to lengthen the effective duration of project outcomes, whether by extending the duration of the award or by tracking participants' progress after leaving the project.
7. Seek autonomy. While dissemination mechanisms are now a required part of nearly every proposal, too many efforts simply lose momentum once the term of funding has ended. Modest, realistic dissemination strategies should be part of every project practically from the outset, with networks and successful outreach continually built upon during the project's successive years. At the end of the development phase, cost-effective dissemination mechanisms such as third-party agents and product clearinghouses should be employed to "spread the word" about the time, energy and funds invested.
8. Aspire to full access and full inclusion. This perhaps puts a new but motivational spin on the term "planned obsolescence." We look forward to a day when special considerations for students with disabilities will be considered redundant if applied broadly and intelligently to regular curricula in use by all.